

In the Drawings

Submitted herewith are three sheets of amended drawings. Upon approval of the Examiner, entry of these replacement sheets is respectfully requested.

REMARKS

Responsive to the outstanding Office Action, applicant has carefully studied the Examiner's rejections and the comments relative thereto. Favorable reconsideration of the application is respectfully requested in light of the amendments and following detailed arguments.

In the amendment, claims 16, 23, 25, 27, 31 and 32 were amended and claim 34 was canceled. It is submitted that no new matter has been entered into the claims through these amendments.

OBJECTIONS TO THE DRAWINGS

The drawings were objected to as including conventional European symbols instead of standard American symbols. Specifically, commas were utilized in the place of decimal points. Applicants herewith submit three corrected drawing sheets utilizing standard US decimals. It is respectfully submitted that, as this was a 371 application, one would recognize the numbers originally presented in light of its European origins, but to insure compliance with US standards the substitute drawings have been submitted.

OBJECTION TO THE DISCLOSURE

The disclosure was objected to for containing the abbreviations APS plasma treatment and APF plasma treatment. It is respectfully submitted that one skill in the art of plasma deposition, which applicants believe is the relevant standard herein, would recognize that APS plasma treatment, as used herein, and specifically in light of the second occurrence of this term which refers to "Leybold electronics APS 904", stands for "advanced plasma system" as is stated in Leybold's literature, and as identified in the description of the Leybold electronics APS 904. As the examples in the application used this particular equipment for the plasma deposition, it follows that this nomenclature would be present. However, in order to insure clarity of the application, the specification has been amended herein to include the language of the acronym.

It is noted, however, that APF is a typo, and should have been APS. This has been corrected herein. In light of the reference on the next line to the Leybold APS 904, it is submitted that one skilled in the art would recognize this as a typographical error, and as such it is being corrected herein.

In light of the above, it is respectfully submitted that the objections to the specification have been overcome.

REJECTIONS UNDER 35 USC §112, first paragraph

The Examiner rejected claims 16-28 and 31-34 under 35 USC 112, first paragraph, for failing to comply with the written description requirement.

Claim 34 has been canceled rendering the rejections thereagainst moot.

With regard to the comprising language, it is first noted that claims 23, 25, 31 and 32 each depend from an earlier Markush grouping, limiting the substrate to a particular set of compounds. These claims merely identified a specific compound from those identified in the Markush groups.

However, for clarity, these claims have been amended to more clearly define what is being claimed. Specifically, each has been amended to include the language “wherein the selected substrate is” which is believed to properly identify one of the earlier claimed Markush groups, and thus properly limit the claims. It is submitted that this does not constitute new matter as these compounds were identified in the application as filed.

Claim 27 is directed towards a product of the process of Claim 16. This claim has been amended to clearly state that it is produced from the process of claim 16.

With regard to claim 16, applicants are somewhat confused by the Examiner's rejection. In amending the claims to more fully comply with the requirements of 35 USC 112, second paragraph, it was not intended to broaden the scope of the claims. Applicant used language which was believed to be consistent with what was already in the claims, but which clearly indicated the interconnectedness of the steps therein.

In an attempt to comply with both the requirements of 35 USC 112 first and second paragraphs, applicants have amended claim 16 as follows:

A process for reducing the surface reflectance of a polymer substrate to less than 2% in the wavelength range from 400 nm to 1100 nm by formation of a refractive index gradient layer in the polymer substrate, the refractive index gradient layer being formed by ion bombardment using high-energy ions, wherein:

a polymer substrate is provided, the polymer substrate has a surface to be bombarded,

high energy ions to be used in an ion bombardment are generated by means of an argon and oxygen plasma as plasma ion source, and

impacting the surface of the polymer substrate by the generated high energy ions in an ion bombardment, wherein

the high energy ions have an energy of from 100 eV to 160 eV, and

the duration of the ion bombardment is from 200 to 600 s, and

the ion bombardment is carried out until the desired refractive index gradient layer with a thickness of at least 230 nm has been formed.

As amended, the preamble of this claim indicates the desired reflectance of the product and indicates it will be achieved by formation of a gradient layer by ion bombardment with high energy ions. To clearly distinguish between preamble and the remainder of the claim, the claim proper provides a polymer substrate with a surface to be bombarded. The next clause introduces high energy ions for an ion bombardment which are generated by an argon and oxygen plasma. The next clause indicates that the surface of the substrate is impacted by the ions generated previously. The remainder of the clauses describe details of the ions and the ion bombardment.

It is believed that the changes to claim 16 overcome the present rejections under 35 USC 112 first paragraph, without introducing new indefiniteness. It is submitted that each feature is specifically defined in the body of the claim, and is properly linked to the remaining parts.

If the Examiner continues to find the language objectionable, the undersigned respectfully requests any suggestions that the Examiner would find clear and acceptable.

In view of the above, reconsideration and withdrawal of the rejections under 35 USC 112, first paragraph are respectfully requested.

REJECTIONS UNDER 35 USC §103

The Examiner again rejected claims 16-28 and 31-33 under 35 USC 103 as being unpatentable over Taniguchi et al. The Examiner states that Tanaguchi teaches making shaped or coated articles, that may be optical particles, using a mixture of fine inorganic particles in a matrix material that may be polymeric compounds. The Examiner acknowledges that Tanaguchi does not disclose information on energies of the ions as they impinge on the substrate or discuss the presence of a refractive index gradient nor the wavelengths involved in the total luminous transmittance measurements. The Examiner states, however, that these numbers would have been obvious to one of ordinary skill in the art.

Claim 16, as amended, defines a process for reducing the surface reflectance of a polymer substrate to less than 2% in the wavelength range from 400 nm to 1100 nm by formation of a refractive index gradient layer in the polymer substrate, the refractive index gradient layer being formed by ion bombardment using high-energy ions, wherein:

a polymer substrate is provided, the polymer substrate has a surface to be bombarded,

high energy ions to be used in an ion bombardment are generated by means of an argon and oxygen plasma as plasma ion source, and

impacting the surface of the polymer substrate by the generated high energy ions in an ion bombardment, wherein

the high energy ions have an energy of from 100 eV to 160 eV, and

the duration of the ion bombardment is from 200 to 600 s, and

the ion bombardment is carried out until the desired refractive index gradient layer with a thickness of at least 230 nm has been formed.

The present invention involves directly impacting the surface of a polymer substrate with ions under conditions mentioned in independent claim 16. The disclosure of Taniguchi addresses a process for producing transparent shaped articles with enhanced anti-reflecting effect. The treatment with an activated gas forms an anti-reflective thin film on a surface of an optical transparent article. The film formed thereby contains finely divided particles of an inorganic substance. These particles have an average particle size in the range 1 to about 300 milli-microns (as reflected in claim 1).

The present invention, as defined in claim 16, discloses the direct ion bombardment onto the surface of a substrate comprising a polymer material. There is no suggestion or disclosure of a coated substrate or one that would be applied with an additional coating. The substrate surface itself is subject to the ion bombardment. It is respectfully submitted that this bombardment of the substrate itself, made from a polymer without any other materials is a significant feature of the present invention.

The Taniguchi reference does not teach a substrate directly ion bombarded as is claimed herein. Taniguchi defines inorganic particles deposited on an organic substrate which requires an additional coating on the surface of the substrate. This coating is the surface layer which influences the optical properties of the finished product. It is this layer of Taniguchi that is bombarded, not the underlying substrate itself as is claimed in the present claim 16.

Polymeric and inorganic materials are known to have greatly differing properties, not limited to but including optical properties. Similarly, conditions for the treatment of polymeric and inorganic materials differ greatly. One skilled in the art would recognize that inorganic materials would not be affected as desired by using energies in the ranges defined in claim 16, i.e. 100eV to 160eV from 200 to 600s.

The taniguchi reference discloses a multi-step process. An organic binder containing inorganic particles is wet chemical applied onto the surface of a substrate.

Subsequently, the organic binder is removed partially by a plasma etching process. Thus the surface of the substrate is essentially formed from the inorganic particles after this treatment. This process would not be suitable for structured surfaces such as Fresnel lenses. The applied mixture would be filling uneven areas and as acknowledged by Taniguchi (table 1) the achievable transmittance would be less than 98%.

It is clear from the above that Taniguchi describes a very different process from that claimed in the present invention. One skilled in the art would not look at Taniguchi for a process not involving an additional coating layer, and even if one did one would not derive the present invention as taught in claim 16.

It is therefore submitted that claim 16, and the claims dependent therefrom, are allowable over the applied art of record.

DOUBLE PATENTING

Claims 16-28 and 31-33 were also provisionally rejected under the doctrine of non-statutory obviousness-type double patenting as being unpatentable over claims 1-7, 12-18 and 24-25 of copending application 11/662,550.

It is again submitted that copending Application 11/662,550 is drawn to a method for forming an optical element for absorbing radiation. This is illustrated in claim 1 of the copending application which claims "a method for the manufacture of a radiation-absorbing optical element that includes a substrate of plastic, comprising the steps of: forming a layer with a graduated refractive index on at least one surface of the substrate, and subsequently applying a metal layer onto the layer with the graduated refractive index."

This is in contrast to the present method for reducing the surface reflectance of an optical element which is formed according to the claimed present invention, requiring argon and oxygen as opposed to a metal. The coating materials are different as are the process steps involved. Further, the metal layer of the copending application could not form a refractive index gradient layer. The refractive index of such a layer would be constant.

Therefore, the subject matter of the claimed inventions in these two applications are only tangentially related and should not be subject to a double patenting rejection.

It is therefore believed that independent claim 16 distinguishes over the applied art of record and is not subject to a double patenting rejection.

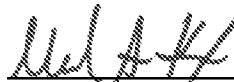
If the Examiner chooses to hold the double patenting rejection applicant holds any further response in abeyance until the provisional nature of the double patenting rejection is removed by the issue of one of the applications.

SUMMARY

In view of the forgoing, independent claim 16 is believed to be allowable over the applied art of record, and action towards that end is respectfully requested. Claims 17-28 and 31-33, which depend directly or indirectly from independent claim 16 are believed to be allowable based, at least, upon this dependence.

Should the Examiner wish to modify the application in any way, applicant's attorney suggests a telephone interview in order to expedite the prosecution of the application.

Respectfully submitted,



Mark A. Hixon
Registration No. 44,766

ATTORNEYS

Marshall & Melhorn, LLC
Four SeaGate - 8th Floor
Toledo, Ohio 43604
(419) 249-7114
(419) 249-7151 Facsimile
HIXON@MARSHALL-MELHORN.COM